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DEPARTMENT OF THE NAVY

COMMANDER OPERATIONAL TEST AND EVALUATION FORCE

NORFOLK, VIRGINIA 23511-6388

3960 (M756-OT-IIIA)  
Ser 561/1227  
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(2)

From: Commander, Operational Test and Evaluation Force  
To: Chief of Naval Operations

Subj: FOLLOW-ON OPERATIONAL TEST AND EVALUATION OF THE CPU-152/A  
STANDARD CENTRAL AIR DATA COMPUTER (SCADC) (OPNAV REPORT  
SYMBOL 3960-12)

Ref: (a) COMOPTEVFOR ltr 3960 (M756-OT-IIIA) Ser 561/0288  
of 25 Feb 88

1. Summary. This is a report of COMOPTEVFOR's follow-on operational test and evaluation (OT-IIIA) of the CPU-152/A Standard Central Air Data Computer (SCADC) as installed in the S-3A/B aircraft from 1-20 July 1990. The purpose of the evaluation was to verify that all the deficiencies from OT-IIC OPEVAL had been corrected prior to approval for full fleet introduction. The evaluation was based on the results of non-scenario operational tests conducted under Project M756, supplemented by the results of OPEVAL, developmental testing, and operational experience. Based on this evaluation, the CPU-152/A SCADC as installed in the S-3A/B aircraft is determined to be operationally effective and operationally suitable. Approval for full fleet introduction of the CPU-152/A is recommended.

2. System Description. The SCADC uses air pressure from the pitot static system and temperature signals from the temperature probe to provide air data outputs for navigation, cockpit display, sonobuoy and weapon delivery systems, Automatic Flight Control System (AFCS), and altitude reporting. While the digital SCADC is a form, fit, and function replacement for the existing S-3 Airspeed Altitude Computer Set (AACS), it has, in addition, a Built-in-test (BIT) function allowing maintenance personnel to determine system status without removing the unit. *Key... Test...*

3. Background

a. The digital SCADC was developed to replaced current analog air data computers in order to improve reliability and upgrade capabilities a per Navy Decision Coordinating Paper No. WO-572-SL of 4 March 1981.

b. Operational testing was conducted by AIRTEVRON ONE from 26 August to 26 November 1987. Four deficiencies were noted which affected Maintainability, Interoperability, and Compatibility. COMOPTEVFOR concluded that SCADC was potentially operationally effective and potentially operationally suitable. Findings supported a recommendation for limited fleet introduction following the correction of the four deficiencies.

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#### 4. Scope

a. Objective. The objective of this evaluation was to verify that all the deficiencies for OPEVAL had been adequately addressed or corrected prior to approval for full fleet introduction.

b. Evaluation Criteria. The evaluation was based on the results of nonscenario operational tests, supplemented by the results of OPEVAL, developmental testing, and operational experience.

c. Limitations to Scope of Testing. The following limitations affected testing, but did not significantly impact the resolution of critical operational issues (COI) and did not preclude the formulation of conclusions concerning operational effectiveness and operational suitability:

(1) No flights were flown from a CV.

(2) The total hours of operation during this phase of testing were not sufficient to provide a demonstrated Reliability, but it is COMOPTEVFOR's judgment that the hours of operation observed without a critical failure will support the mission and is operationally satisfactory.

(3) Mean Time to Repair (MTTR), could not be determined for this phase of testing because there were no SCADC failures observed and there were no prefaulted modules available.

#### 5. Project Operations

a. This additional phase of nonscenario operational testing was conducted from 1 to 20 July 1990 using the CPU-152/A SCADC installed on AIRTEVRON ONE S-3B aircraft bureau number 160591 and S-3A aircraft BUNO 159403.

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b. Fifteen sorties totalling 28.4 hours were flown as follows:

	<u>Hours</u>	<u>Sorties</u>
Visual navigation	3.0	2
Airways navigation	11.3	5
MINEX/BOMBEX	3.3	1
Functional check flight	2.9	3
Other	7.9	4

6. Results and Discussions. Major test results are listed below and address each OPEVAL deficiency:

a. Correct the invalid fault code 65 in the BIT (Maintainability). A valid BIT code 65 indicates a major failure of the SCADC and requires replacement of the unit. NAVAIRTESTCEN determined that this erroneous fault code was caused by improper communication between the SCADC and AFCS when the AFCS self-test was run. A 2-minute 30-second delay has been incorporated into the SCADC whenever the AFCS self-test is run to prevent the SCADC from sensing a failure. No code 65 faults were observed during test operations; therefore, this deficiency is considered corrected and the Maintainability COI is resolved as Satisfactory.

b. Correct the interoperability problem between SCADC and the System Test Program (STP) in the fleet issue software (Interoperability). Neither the S-3A Fleet Issue (FI) A4.1 nor S-3B FI B4.2.2 software had the capability to run the SCADC STP. This deficiency did not affect the performance of the SCADC in the aircraft. A software patch to include the SCADC STP into FI A4.1 is being developed by NAVAIRDEVCEEN. The SCADC STP for the S-3B is a planned improvement for FI B4.3 software scheduled for Operational Testing in the first quarter FY92. Since the SCADC/STP interface will be tested via normal software release, no further testing is required under this program.

c. Modify SCADC to allow the unit to be set down without damaging the metal guard on the back, and eliminate the foreign object damage (FOD) hazard (Compatibility). This previously identified deficiency was not corrected. After a thorough review by the test team, this anomaly was reevaluated to be of insufficient magnitude by itself to resolve the COI as unsatisfactory. It is now an operational consideration; therefore the Compatibility COI is resolved as Satisfactory.

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d. Verify correction of intermittent lagging true airspeed on pilot and copilot Horizontal Situation Indicator displays (Interoperability). NAVAIRTESTCEN determined that this Deficiency was the result of the SCADC clock pulse being out of sync with the navigation data converter repeater clock pulse. A wiring change has been incorporated in the SCADC to synchronize the two clock pulses. During test operations, level accelerations and decelerations as well as maximum rate descent profiles were flown to verify this correction. No problems were noted during this phase of testing. This deficiency is considered corrected and the Interoperability COI is resolved as Satisfactory.

7. Critical Operational Issues. All COIs were resolved as follows:

<u>Critical Operational Issues</u>	<u>Resolution</u>
Reliability	Resolved (SAT)
Maintainability	Resolved (SAT)
Interoperability	Resolved (SAT)
Compatibility	Resolved (SAT)

8. Operational Considerations

a. SCADC was designed with a radiant cooling system. Radiant heat exchange may cause avionics near the SCADC to exhibit failures due to increased temperature induced by the SCADC. No failures of neighboring avionics were identified during this phase of testing.

b. To prevent possible FOD on board the CV, maintenance personnel should refrain from installing plastic covers on the pitot-static couplings until below decks. Without these covers installed, care should be exercised in handling the SCADC during maintenance evolutions to prevent damage to the pitot-static couplings on the back of the unit.

9. Conclusions

a. The CPU-152/A SCADC, as installed in the S-3A/B, is operationally effective.

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b. The CPU-152/A SCADC, as installed in the S-3A/B, is operationally suitable.

c. The operational effectiveness and operational suitability findings support a recommendation for full production of the CPU-152/A SCADC for the S-3A/B.

10. Recommendation. Approve CPU-152/A SCADC, as installed in the S-3A/B, for full fleet introduction.

11. Other Recommendations

a. Continue to develop and incorporate STP software for the S-3A and S-3B compatible with the SCADC.

b. Include a warning in the appropriate maintenance manuals concerning both the potential FOD hazard of installing plastic covers on the flight deck and careful handling of the SCADC to prevent damage to the pitot-static couplings.

c. Continue evaluation of the CPU-152/A SCADC to gather additional data for Reliability and Maintainability.

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